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A Pop-up Calculator

Even though computers are nothing but fancy calculators, it's surprising how hard it is to use some computers for making simple calculations. For example, if you want to add an arbitrary string of numbers on a Pick computer, you have three clumsy choices: (1) write a BASIC program to input and total numbers, (2) save the numbers in a file and total them with a command like SUM, or (3) use a bunch of awkward ADDD commands to compute partial sums and total those up. Shouldn't there be an easier way?

The CALC program on page 6 *is* an easier way. It displays a calculator on the screen and allows the operator to input arbitrary calculations. As the user operates the terminal's keypad, the results of calculations are simultaneously displayed by the on-screen calculator, just like a real adding machine. With the CALC program, it's no longer necessary to keep a real calculator on the same desk with a Pick computer terminal. A Pick computer can now also easily operate as a simple desk calculator.

Calculators come in a variety of flavors. Some use reverse polish input, some use infix notation, some are scientific oriented, some are accounting-style adding machines, and so on. CALC only performs simple arithmetic, and does it in "human readable" style. For example, pressing the keys "3", "+", "2", "-", "1", "=" results in a display of 4.

CALC begins by defining some string constants, then clearing the screen and homing the cursor in line 2. COL and ROW in line 3 define the upper left hand corner of the displayed calculator. You can change just that line to make the calculator appear anywhere on the screen. If your terminal allows the computer to sense the current contents of the screen, such as by sending the ESC 6 command to a Wyse 50 terminal, you may want to modify CALC to first save the contents of the screen, then display the calculator, then restore the

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```
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MARSHA PICKUSER
555 PROGRAMMER HWY #8080
APTOS CA 95003
```

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screen contents when CALC is done, thereby providing a true pop-up calculator that doesn't wipe out the current display.

Line 20 nulls the prompt character so that question marks don't appear on the screen, then resets the primary CALC variables: OPERAND, RESULT, and OPERATOR. OPERAND is used to hold the current number being input by the user. RESULT holds the result of all calculations so far. OPERATOR remembers the pending operation to perform after the user is done typing the current OPERAND.

Line 21 initializes the calculator's display format to 4 digits of precision. Typing a number and then hitting the P key will make the calculator display from 0 to 4 digits of precision.

The calculator's logic is controlled by the large LOOP from lines 22 to 73. If a new OPERAND is being input, it is displayed by line 25, otherwise the current RESULT is displayed with appropriate precision by line 26. Line 28 waits for the next keystroke. If an ⬤ input, the LOOP exits at line 29, the screen is cleared at line 74, and CALC stops.

Any other input gives control to one of the various CASE clauses in the LOOP. In every valid CASE, KEYCOL and KEYROW are set to the screen position of the pressed key, the press subroutine is called to animate the key to provide some simple visual feedback, the appropriate calculation or adjustment is made to variables, and the release subroutine is called to finish the animation. The press and release subroutines simply display XXX at the key position and then restore the screen. The SYSTEM(13) call in press causes a timeslice quantum release to slow the animation enough to be noticeable. All press and release references can be removed from CALC without harming any of the calculator's logic.

Typing a digit from 1 to 9 causes the CASE at line 32 to be reached. The tricky mapping in lines 33 and 34 takes advantage of the regular layout of the numeric keys and avoids having to have a separate CASE for each digit. When a digit is typed, line 36 or 39 simply appends the digit to the OPERAND. A decimal point is also appended to OPERAND in line 69, but only if the

OPERAND doesn't already contain a decimal point, as determined by the test in line 67.

The C key clears the calculator by calling the reset subroutine in line 43. The P key uses the previously input digit to change the calculator's precision by calling the digits subroutine in line 54.

The +, -, /, *, and = keys all compute a running RESULT by calling the execute subroutine to force the

See what you're missing...

```
                                                        VVVVV
    RO LAND      13407 DISCOVERY SYSTE 1216 E 132ND ST  55417
    HE YAHG      92711             12236 RIVERWOOD DR    55417
    GA FINE       8812             12513 MYSTIC LN       55417
    CH FITZPATR 82763 MOUNTAIN BELL  12729 PARKWOOD DR   55417
    H  AVILES    11837 MOSLER SAFE CO 13109 PENN S       55417
    H  BOUGHOUT  63920             14784 W 52ND AVE      55417
    C  RICHMOND  35737              5220 GARRISON ST #6  55417
    S  HANNA     63914 BAILEY ELECTRON 5280 TABOR ST     55417
    S  YU        41066 TAMS CHINESE FO 5282 UNION CT #2  55417
    ------------------------------------------------------------
    MA BUCKLEY   63931 BROKERS THREE R 5387 CARR ST #317 55417

    PA DECOSTER  97530              5425 VIVIAN CIR      55417
    A  PEYTON      332              7903 RALSTON RD      55417
    KE HOPTON    82771 TELEDYNE CONTRO 4920 W 69TH AVE   55418
    KE DALLARA   82769 EAGLE PUBLISHIN 5550 W 80TH PL #44 55418
    M  TOBIN     11363              5610 W 71ST CIR      55418
    HO RODGERS   96529 SOUTHWESTERN UN 5853 PIERCE ST #103 55418
    PA LI        74400 CARTER CO       6917 W 83RD WAY   55418
    JI LOOTA     82777              7040 W 75TH PL 1809  55418
    M  BUECHLER  63943 SOFTWARE RESEAR 7355 WEBSTER ST   55418

    N/U/UU/D/DD/W1/W2/Z/C/L/X/return/chars/lname(;fname)/(.)id#?
```

```
    PONUM VENUM VENAME... ITM DESCRIPTION... D# |DUE.....| QTY..
                                                |vvvvvvvv|
    10203  122  JAMECO     1 POT, LINER, 2W  1 |02-02-87| 1000
    10203  122  JAMECO     2 POT, LINER,.5W  1 |02-02-87| 1000
    10203  122  JAMECO     3 CAP, MICA, 10P  1 |02-02-87| 1000
    10377 6620  EDS CORP   1 74ALS00 NAND    1 |02-02-87| 1000
    10377 6620  EDS CORP   1 74ALS00 NAND    2 |02-04-87|  610
    10203  122  JAMECO     1 POT, LINER, 2W  2 |02-09-87| 1000
    10203  122  JAMECO     2 POT, LINER,.5W  2 |02-09-87| 1000
    10377 6620  EDS CORP   2 74ALS112 DUALF  1 |02-09-87| 1000
    10203  122  JAMECO     1 POT, LINER, 2W  3 |02-16-87| 2000
    10203  122  JAMECO     2 POT, LINER,.5W  3 |02-16-87| 2000
    10203  122  JAMECO     3 CAP, MICA, 10P  2 |02-16-87|  500
    10377 6620  EDS CORP   2 74ALS112 DUALF  2 |02-16-87| 2000
    10377 6620  EDS CORP   2 74ALS112 DUALF  3 |02-20-87| 1000
    10203  122  JAMECO     2 POT, LINER,.5W  4 |02-23-87|  500
    10377 6620  EDS CORP   3 N8277 8B SHIFT  1 |02-23-87|  500
    10377 6620  EDS CORP   3 N8277 8B SHIFT  2 |02-24-87| 1000
    10377 6620  EDS CORP   3 N8277 8B SHIFT  3 |02-25-87|  500
    10377 6620  EDS CORP   3 N8277 8B SHIFT  4 |02-26-87|  500
    10377 6620  EDS CORP   2 74ALS112 DUALF  4 |03-09-87|  750
    10377 6620  EDS CORP   2 74ALS112 DUALF  5 |03-24-87| 2000
                                                |^^^^^^^^|
    (U)p/(D)own/(L)eft/(R)ight/(E)xit/date/desc/PO#?
```

Within minutes of loading the B-TREE-P source code, this customer began using B-TREE-P's standard "browser" for searching a 120,000+ record customer master file. Any name, company, or address can immediately be located and displayed, just by typing one or more characters that match the field. No more waiting for SELECTs!

This customer has set up B-TREE-P for purchase order inquiries. A file of multivalued line items and submultivalued delivery dates and quantities can instantly be viewed by item or by date. Pages can be scrolled at the terminal, forward or backward. Any range of data can be instantly printed. No more waiting for SORTs!

Tired of waiting for your computer to SORT or SELECT your large data files? Need to quickly find *any* attribute? Want to scroll files up or down, in any sort order? Now you can use B-TREE-P to instantly search, sort, and scroll any data from any file!

Now you can instantly look up customers by name, street, Zip code, or any other field — not just by customer number. Now you can immediately find inventory entries by quantity, cost, or description — not just by part number. Whatever files you use, now you can instantly locate and display your data *any way you want*, without having to wait for endless SORTs and SELECTs.

Immediately display any record in any file just by typing one or more starting characters that match any field in the record. You can display not only a selected record, but also any previous and next records, using any sort order you specify. You can jump to any record in a file at any time, then browse through the file by scrolling up or down, a record at a time or a page at a time, in any sort order.

As one of Semaphore's programmers says: "We often ask ourselves why we waited so long to create B-TREE-P. After using it for our own production work, we wonder how we ever got by before without it. A Pick computer without B-TREE-P is like a car without wheels".

...until you use B-TREE-P!

```
Current Balance ID Number Location Inmates as of 20:34:37
------- ------- --------- -------- ----------------------
  132.99 87-015044 MCC A872 HAESSIG, GENE JASON
    0.00 87-205075 MCC B402 HAHN, ROBERT JAMES
   20.00 87-009589 MJ 7665  HAHN, STEVEN MARK
    0.99 87-019503 MJ 33    HALL, GEORGE
    0.00 87-020649 MJ 2234  HANSEN, DAVID AMES
   32.47 87-020536 MCC D883 HANSOM, JAY LEONARD
    0.85 87-001584 MCC D228 HARGER, LIN AKA HANSON
    0.24 87-002064 MJ 2277  HARPER, JAMES
             +---------+
    0.08 87-020596 MCC C877 HARRIS, WILLIAM KENNETH
             +---------+
  145.55 86-194689 MCC A872 HARRISS, BARRY MICHAEL
    2.63 87-019655 WCC      HARTLEY, JERRY
    0.00 86-023332 WCC      HAWKINS, ANDREW
    0.02 86-015797 MCC F99  HAY, THOMAS MAYNARD
   12.72 87-888802 MJ 223   HEATH, JACK ROBERT
    0.76 87-204408 MCC D22  HEBERT, JOSEPH
   24.81 87-992223 MCC E333 HEIDENREICH, JAMES
    0.00 87-884552 MJ 221   HELSETH, LAWRENCE JAMES
   30.99 86-866866 MJ 2255  HELTON, JAMES AKA MIKE
Type an ID number, name, command, or hit RETURN: _____
Commands are: NEW CHANGE PRINT DISPLAY DROP PRIOR NEXT MOVE
```

```
ORDER CUST# CUSTOMER   I# DESCRIPTION..... S# SHP DATE QTY..
                  ****************
33033 A100  AEROSPACE  02 BENCH, LAMINATED 01 09-10-87   10
EXP: N/A    PROD: N/A     SHIP: N/A
------------------------------------------------------------
35220 L788  LINCOM CO  02 BENCH, LAMINATED 01 11-10-87   10
EXP: SALLY  PROD: JAMES   SHIP: QA CHECK
------------------------------------------------------------
35220 L788  LINCOM CO  02 BENCH, LAMINATED 02 12-10-87   10
EXP: SALLY  PROD: N/A     SHIP: N/A
============================================================
33033 A100  AEROSPACE  01 CASE, CLOCK, INS 01 09-10-87   10
EXP: N/A    PROD: N/A     SHIP: QA CHECK
============================================================
35220 L788  LINCOM CO  01 CASE, CLOCK, INS 01 09-10-87    2
EXP: N/A    PROD: N/A     SHIP: QA CHECK
------------------------------------------------------------
35220 L788  LINCOM CO  01 CASE, CLOCK, INS 02 10-10-87    4
EXP: N/A    PROD: JAMES   SHIP: QA CHECK
------------------------------------------------------------
33033 A100  AEROSPACE  03 TIP, PROBE, BAKE 01 09-10-87   10
EXP: N/A    PROD: N/A     SHIP: QA CHECK
                  ****************
SO# or Find or by: Part, Desc, Date, Rep, Name, Terr?
```

This county jail uses B-TREE-P for inmate cash accounting. Although cash records are filed by inmate booking numbers, B-TREE-P allows a list alphabetized by the name attribute to be displayed at all times, even as records are created and deleted at other terminals. Any inmate record (or nearest match) can be immediately found and displayed just by typing one or more characters in a name.

This manufacturer uses B-TREE-P to let marketing personnel instantly display sales orders six different ways: by part, by description, by ship date, by sales rep, by customer name, and by sales territory. With just a few keystrokes, operators can instantly display records under a new sort (subsorts too) or find and output a given item.

B-TREE-P is a proven collection of BASIC subprograms for using B-trees on your computer system. B-trees allow any of the data in any of your files to be instantly located and displayed in any sort order, without having to wait for SORT or SELECT commands.

B-TREE-P and a few optional minor modifications to your existing data entry programs are all that is necessary for you to immediately be able to search, browse, display, or print your data quickly and conveniently. Modifications to your existing data files are absolutely unnecessary!

B-TREE-P includes all necessary BASIC source code for a B-tree system that works with any file. Included are an insertion subroutine, deletion subroutine, lookup subroutine, previous/next subroutine, and complete instructions. Plus, you receive the source code for a complete demonstration system that uses B-TREE-P to maintain a name and address file, including an editor program for creating and changing name and address records, a browser program for displaying records, and a printer program for listing file items in order without having to wait for a sort.
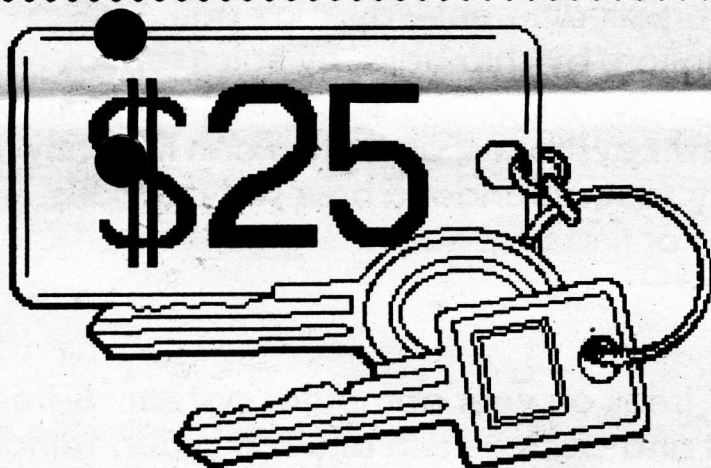
To order, send your name, address, telephone number, and your check for $395 (plus tax in California) payable to Semaphore Corporation at 207 Granada Drive, Aptos, CA 95003. Or call us at (408) 688-9200 for more information or to place a COD order. We'll send you complete B-TREE-P source code listings and all necessary documentation, along with all back issues of our special B-tree newsletter.

```
CALC
001 beep = CHAR(7) ; pressed = "XXX"
002 clear = @(0,0):@(-1) ; CRT clear:
003 COL = 20 ; ROW = 5
004 CRT @(COL,ROW  ):"+----------------+":
005 CRT @(COL,ROW+ 1):"|----------------+|":
006 CRT @(COL,ROW+ 2):"|                ||":
007 CRT @(COL,ROW+ 3):"|+--------------+||":
008 CRT @(COL,ROW+ 4):"|+--------------+||":
009 CRT @(COL,ROW+ 5):"||C | / | * | P ||":
010 CRT @(COL,ROW+ 6):"||---+---+---+---||":
011 CRT @(COL,ROW+ 7):"|| 7 | 8 | 9 | - ||":
012 CRT @(COL,ROW+ 8):"||---+---+---+---||":
013 CRT @(COL,ROW+ 9):"|| 4 | 5 | 6 | + ||":
014 CRT @(COL,ROW+10):"||---+---+---+---||":
015 CRT @(COL,ROW+11):"|| 1 | 2 | 3 |   ||":
016 CRT @(COL,ROW+12):"||-------+---|   ||":
017 CRT @(COL,ROW+13):"|| 0     | . |   ||":
018 CRT @(COL,ROW+14):"|+--------------+||":
019 CRT @(COL,ROW+15):"+----------------+":
020 PROMPT "" ; GOSUB reset
021 PREC = 4 ; GOSUB digits
022 LOOP
023   CRT @(COL+2,ROW+2) :
024   IF OPERAND # "" THEN
025     CRT OPERAND "R#15":
026   END ELSE CRT RESULT FORMAT:
027   CRT @(COL+16,ROW+2) :
028   INPUT KEY,1:
029 UNTIL KEY = "X" DO
030   VAL = INDEX("123456789",KEY,1)
031   BEGIN CASE
032   CASE (VAL > 0) AND (KEY # "")
033     KEYCOL = COL+(MOD(VAL-1,3)*4)+2
034     KEYROW = ROW+(INT((9-VAL)/3)*2)+7
035     GOSUB press ; KEY = VAL
036     OPERAND = OPERAND:KEY ; GOSUB release
037   CASE KEY = "0"
038     KEYCOL = COL+2 ; KEYROW = ROW+13
039     GOSUB press ; OPERAND = OPERAND:KEY
040     GOSUB release
041   CASE KEY = "C"
042     KEYCOL = COL+2 ; KEYROW = ROW+5
043     GOSUB press ; GOSUB reset; GOSUB release
044   CASE KEY = "/"
045     KEYCOL = COL+6 ; KEYROW = ROW+5
046     GOSUB press;GOSUB execute;GOSUB release
047   CASE KEY = "*"
048     KEYCOL = COL+10 ; KEYROW = ROW+5
049     GOSUB press;GOSUB execute;GOSUB release
050   CASE KEY = "P"
051     KEYCOL = COL+14 ; KEYROW = ROW+5
052     GOSUB press ; PREC = INT(OPERAND)
053     IF (0 <= PREC) AND (PREC <= 4) THEN
054       GOSUB digits ; GOSUB reset
055       END ELSE CRT beep:
056     GOSUB release
057   CASE KEY = "-"
058     KEYCOL = COL+14 ; KEYROW = ROW+7
059     GOSUB press;GOSUB execute;GOSUB release
060   CASE KEY = "+"
061     KEYCOL = COL+14 ; KEYROW = ROW+9
062     GOSUB press;GOSUB execute;GOSUB release
063   CASE (KEY = "=") OR (KEY = "")
064     KEYCOL = COL+14 ; KEYROW = ROW+13
065     GOSUB press ; KEY = "="
066     GOSUB execute ; GOSUB release
067   CASE (KEY=".") & (INDEX(OPERAND,".",1)=0)
068     KEYCOL = COL+10 ; KEYROW = ROW+13
069     GOSUB press ; OPERAND = OPERAND : KEY
070     GOSUB release
071   CASE 1 ; CRT beep:
072   END CASE
073 REPEAT
074 CRT clear:
075 STOP
076 *
077 reset: OPERAND="" ; RESULT=0 ; OPERATOR="+"
078 RETURN
079 *
080 digits: PRECISION 4; FORMAT="R":PREC:",":#15"
081 RETURN
082 *
083 press: CRT @(KEYCOL,KEYROW) :pressed:
084 IGNORE = SYSTEM(13)
085 RETURN
086 *
087 release: CRT @(KEYCOL,KEYROW) :" ":KEY:" ":
088 RETURN
089 *
090 execute: *
091 BEGIN CASE
092 CASE OPERATOR = "="
093   IF OPERAND # "" THEN RESULT = OPERAND
094 CASE OPERATOR = "+"
095   RESULT = RESULT + OPERAND
096 CASE OPERATOR = "-"
097   RESULT = RESULT - OPERAND
098 CASE OPERATOR = "*"
099   RESULT = RESULT * OPERAND
100 CASE OPERATOR = "/"
101   IF (OPERAND = 0) OR (OPERAND = "") THEN
102     CRT beep: ; GOSUB reset ; RETURN
103   END
104   RESULT = RESULT / OPERAND
105 END CASE
106 OPERATOR = KEY ; OPERAND = ""
107 RETURN
108 END
```

previous pending OPERATOR to be executed. Following CALC's logic during the input of 2*3+4= is a good way to understand how it all works. Initially, the reset subroutine sets OPERAND to null, RESULT to zero, and OPERATOR to +.

When 2 is typed, OPERAND becomes 2 at line 36. When * is typed, execute is called at line 49. Since the pending OPERATOR was initialized to + (just a convenient way to get things going), OPERAND is added to RESULT and the total 2 is saved in RESULT at line 95. OPERATOR is then set to the new pending value of * and OPERAND is cleared to null in line 106.

When 3 is typed, OPERAND becomes 3 at line 36. When + is typed, the pending OPERATOR is *, so OPERAND is multiplied with RESULT and the total 6 is saved in RESULT at line 99. OPERATOR is set to + and OPERAND is cleared again in line 106.

When 4 is typed, OPERAND becomes 4 at line 36. When = is typed, the pending OPERATOR is +, so OPERAND is added to RESULT and the total 10 is saved in RESULT at line 95. OPERATOR is left set to = and OPERAND is cleared again in line 106. Line 26 then displays the final RESULT while waiting for the user's next input.

After = has been typed and the final RESULT is displayed, two kinds of subsequent input may occur. The user might begin a new calculation by starting with a new number (for example, by typing 1+2=), or the user might operate on the currently displayed result by starting with just an operator (for example, by typing *8=). Once a new arithmetic function key is typed after a previous result has been displayed, line 93 makes the necessary adjustment to OPERAND and RESULT to either start a new

calculation or operate on a prior RESULT.

Although CALC is a convenient tool already, you may want to enhance it with other calculator capabilities, such as more function keys, better precision, more memory, or programmability. How about a version with a scrolling "paper tape" instead of just a one-line display?

New B-TREE-P installations are sprouting up every day!
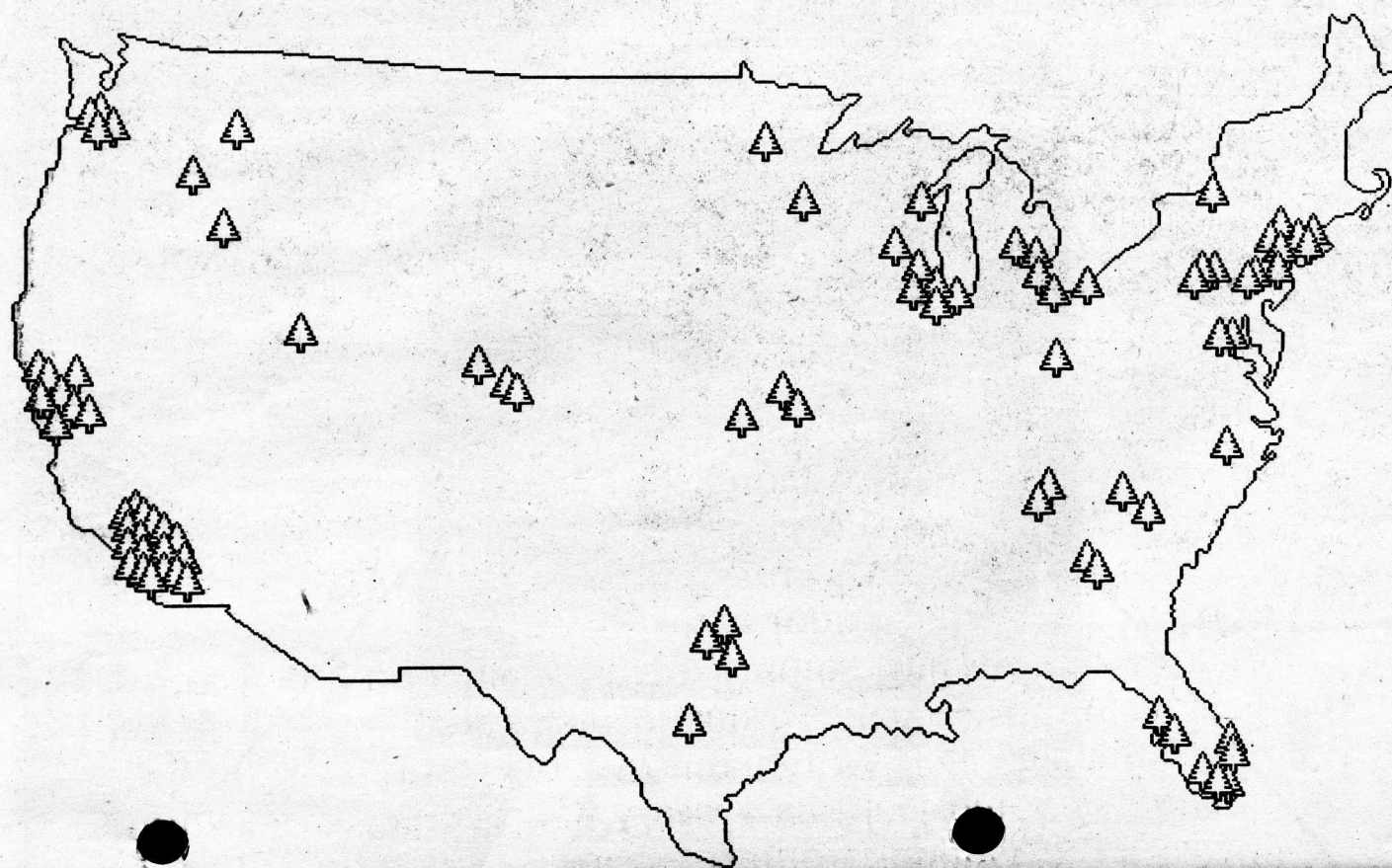
B-TREE-P is software that allows your data to be instantly located and output, without having to wait for lengthy file sorts or searches. Join the growing number of sites discovering the power and flexibility of B-TREE-P. Write or call Semaphore Corporation, 207 Granada Drive, Aptos, CA 95003, (408) 688-9200.

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